NOAO Experiments in Science Education: Lessons Learned

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NOAO Education Goal:

National Center of Leadership and Excellence in Science Education

- *Use synergy in education areas to inform your projects*

NOAO Science Education Approach (This is what works well for us)

- Diverse science-oriented development teams
- Portfolio of projects, audiences, approaches
- Strategic partnering
- Experimentation and prototyping important

- Science education program must fit into the organizational niche

Motivation: Major issues for us to address

- Fragmentation of formal education system. Increased prominence of informal institutions, "free choice" learning
- Teachers retiring or teaching out-of-field and associated professional development problems. "No Child Left Behind" act in US counterproductive
- Instructional materials in classroom are lacking
- Teacher isolation, school administration obstacles

Respond to the most significant long-term education problems

Current Approaches/Projects

1. Increased emphasis on informal science activities and kits (*Hands On Optics*, *Revealing the Invisible Universe: From Nanoscope to Telescope*)

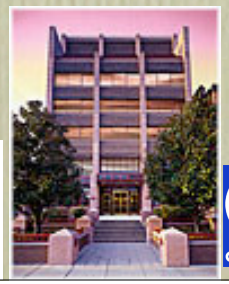
2. Community-based science education (*ASTRO*, *Family ASTRO, CATTS)*

3. Use of technology to emphasize science process (*Astronomy Village: Investigating the Solar System, Investigating Astronomy*-new high school program)

4. Intense professional development and research experiences for teachers (GEMS workshops, *ASTRO Chile*, *TLRBSE*)

5. Spanish Language Astronomy Materials

1. Informal Science Emphasis



Hands-On Optics …

- Is an NSF informal after-school program for middle school
- Includes a professional development program for teachers and industry volunteers
- Creates and provides optics experiment kits
- Is a long-term program for MESA, OSA, SPIE, and NOAO

Choose your partners carefully

Internships for Communicating Science

Kitt Peak Teacher Intern Program
-Four teachers from 3 local districts
-Development of programs, infrared exhibit

Flandrau Science Center Student Program
-"Revealing the Invisible Universe: From Nanoscopes to Telescopes" NSF-sponsored project.
-Infrared astronomy and remote sensing programs

- *College students are a valuable resource but …*

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2. Community-Based Science Education

Reaching South Tucson: *Family ASTRO*

Partnership with the Astronomical Society of the Pacific, built on Project ASTRO success story

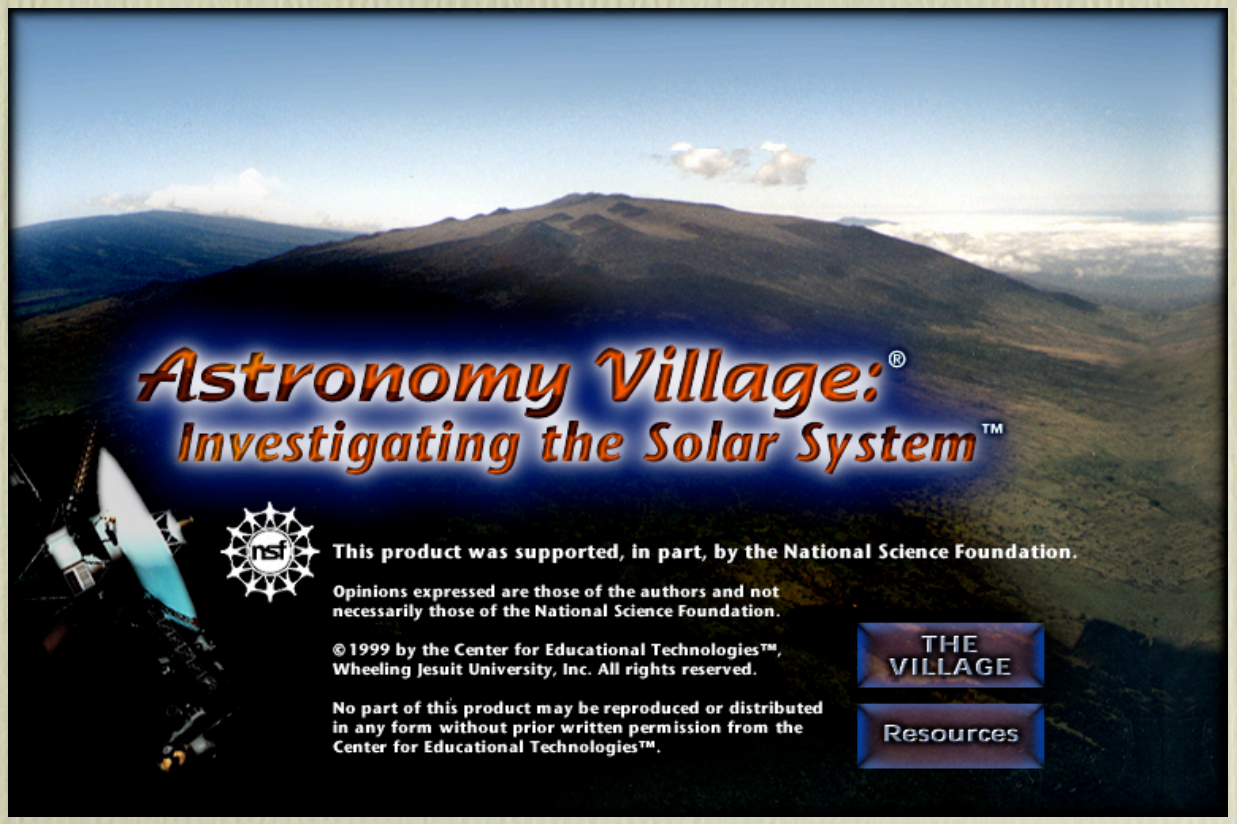
Local Partners:

- Sunnyside School District
- Tohono O'odham Nation schools
- Girl Scouts
-

Go to your audience/learn from them

New Approaches to Community Involvement:
Collaborative to Advance Teaching Technology and Science (CATTS GK-12)

3. Use of Technology to Emphasize Science Process: *Astronomy Village* and *Investigating Astronomy*



“Research Group Briefing”

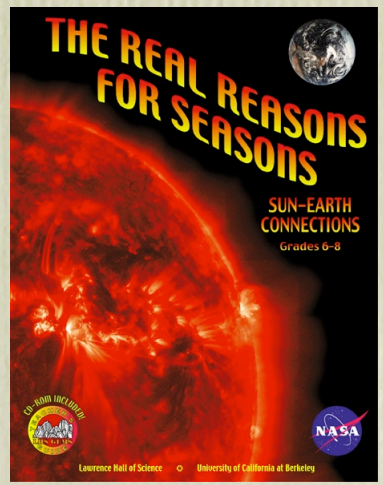
Data Collection Methods

4. Intense Professional Development and Research Experiences for Teachers

GEMS Great Explorations in Math and Science
Lawrence Hall of Science
University of California, Berkeley

Invisible Universe: The Electromagnetic Spectrum from Radio Waves to Gamma Rays

Grades 6–8



Instructional Materials Development:
Teachers Guides in the LHS GEMS series

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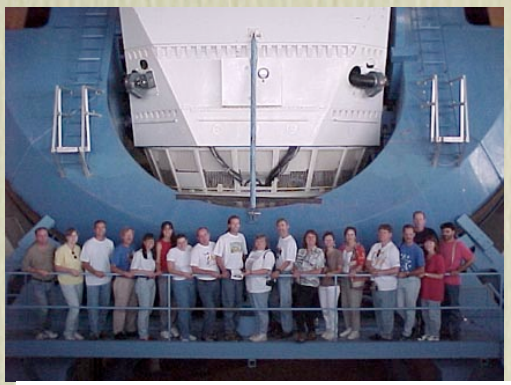
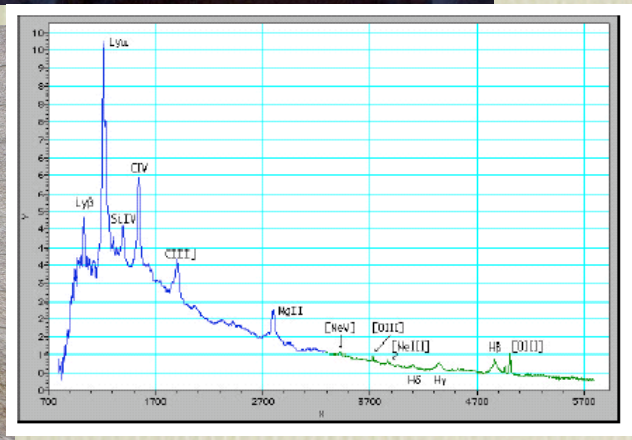
Outreach in Chile: ASTRO-Chile Video Workshops on Spectroscopy, Light Pollution

Professional Development for Teachers: Research Experiences Aid Retention and Renewal

Teacher Leaders
in Research Based Science Education





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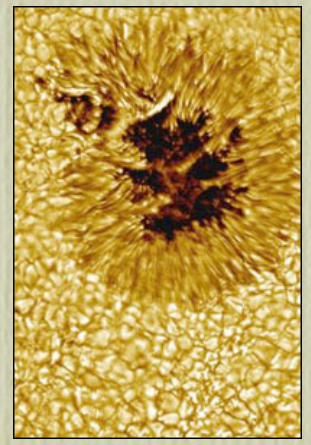
TLRBSE Research Projects



Solar Magnetic Fields

Study how magnetic fields create features on the solar surface!

Spectroscopy of Giant and Supergiant Variable Stars

Probe the strange behavior of irregular variable stars!

AGN Spectroscopy

Uncover the mysteries of distant galaxies!

Nova Search

Discover flaring novae in nearby galaxies!

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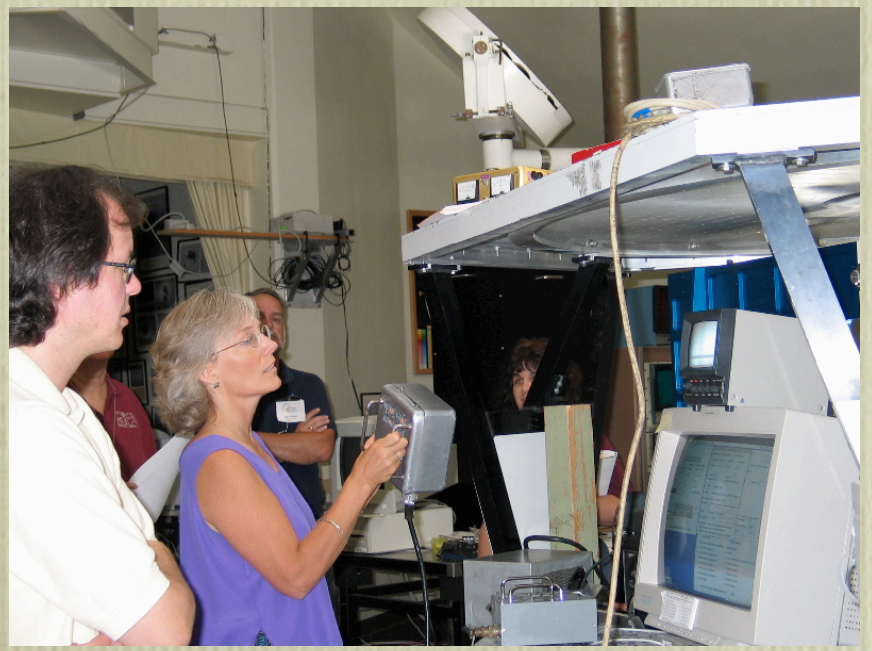
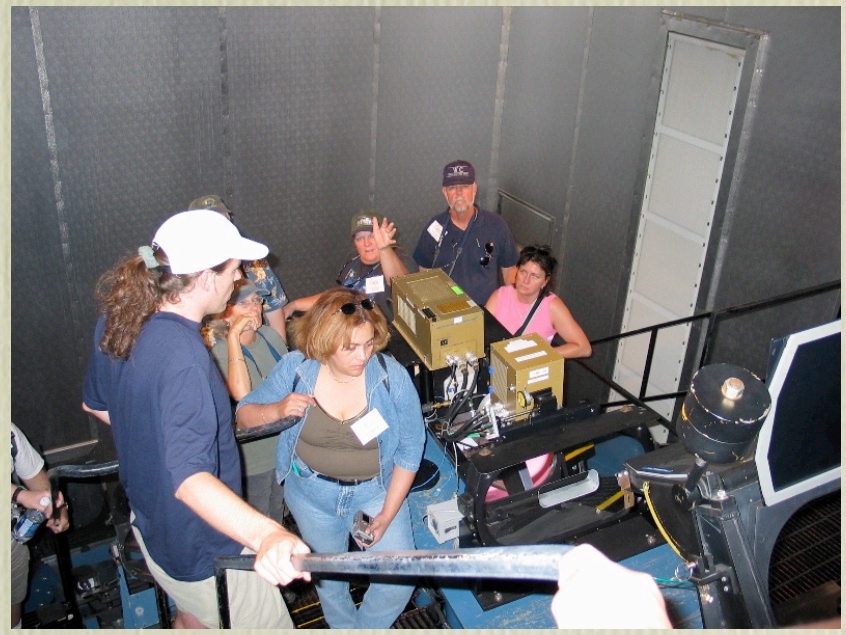
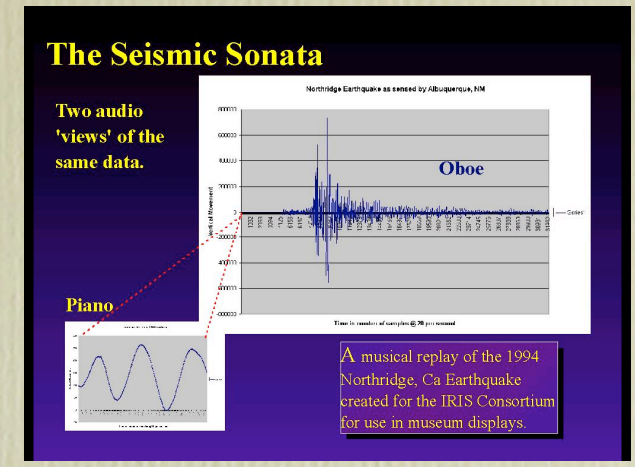
Observing Program for Teachers





Sonification Research

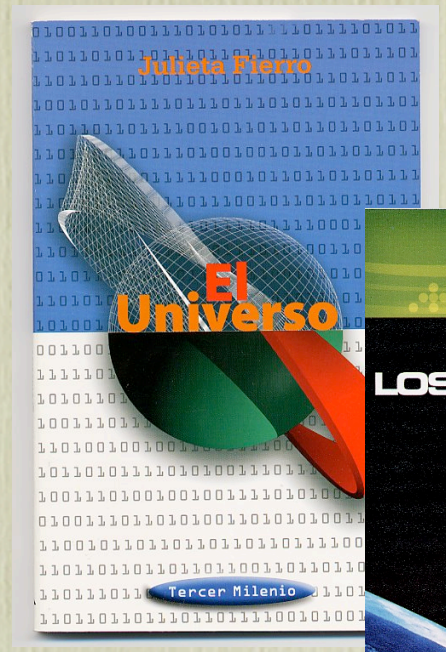
- Collaboration with Marty Quinn
- Conversion of data sets to music (started with Mars GRS data)
- Testing for educational effectiveness
- One goal is to create "auditory display" best practices document

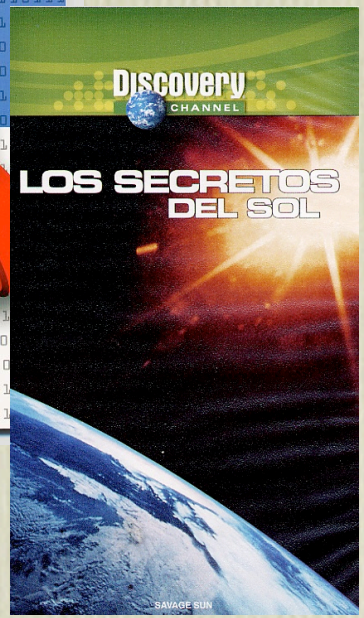


5. Spanish Language Astronomy Materials

http://www.astronomiaenespanol.org/

http://www.astronomyinspanish.org/





A portfolio of projects/ audiences

FORMAL	INFORMAL	MEDIA/ OUTREACH
Project ASTRO ASTRO Chile	Family ASTRO	"Communicating Astronomy"
TLRBSE	Kitt Peak Visitor Center	Webcasts
Spanish Materials Center	Hands-On Optics	Press Releases
GEMS, CATTS	Internships in Public Science Education	Posters, Data Products

Conclusion

- Audience diversity is a valuable resource: NOAO has a wide variety of audiences: local, regional, national, Spanish speaking, Native American, all age levels
- Leadership implies learning/advancing in our programs in informal science education, teacher professional development, and teacher-scientist partnerships as well as media-related material
- Kit and supplemental materials development keep us intellectually challenged and in touch with our audiences
- NOAO has a prime focus on value added to research and in creating research and investigation experiences